

camel's hair brush with attached blower bulb, for example). The use of canned or compressed air should be avoided, if possible, as the propellant in the can may spit out and leave difficult-to-remove deposits on your lens. Also, the expanding compressed air drops in temperature as it leaves the can. The cold air coming out of the tiny tube that most compressed air cans use to direct the air flow has been known to chill a lens to the point of spalling chips off the lens if pointed at the same spot on the glass for too long.

If you want, or need, to use compressed air to remove stubborn particles, use a high quality compressed air duster (of the R-134 propellant type). ChemTronics sells a high-quality unit. Do not tip or shake the can. Blow any loose particles off the lens surface using short blasts at an angle to the glass, without getting too close to the lens surface or aiming directly at it.

Next, moisten a ball of USP grade pure cotton with a few drops of a photographic-quality optical cleaning solution designed for multicoated camera and binocular lenses. You can use Formula MC (available from many telescope dealers) or your own mixture of distilled water and a drop or two of mild soap. A well-worn 100% cotton handkerchief also works well and Zeiss and Kodak both make suitable cleaning fluids. Blot the entire surface with the dampened cotton ball or cloth to pick up any stubborn particles and to clean the surface. Exchange the cotton ball and/or turn the cloth frequently so you always have a clean portion of the cotton ball or cloth in contact with the lens.

Use a very small amount of liquid – not so much that the fluid could be wicked between the lenses by capillary action. Do not drip the cleaning fluid directly on the lens. Do not, at any stage, apply hard pressure. Using a fresh piece of cotton or a lint-free white facial tissue, carefully clean the surface of the lens by wiping across in a radial direction. Repeat the process with denatured alcohol, using a blower brush to clean off any dust that may fall on the lens as you are cleaning it.

If you want to take the ultimate step in cleaning, a final rinse with high-grade acetone will clean the surface to new condition. You may notice a few faint streaks from the dried solvent. They will not affect performance, but they can be removed with light pressure and a Q-Tip slightly moistened with a small amount of alcohol or acetone. Finally, a clean air blower bulb can be used to remove any remaining dust.

Avoid overcleaning your scope. The multicoatings on the lens are quite hard and durable. However, frequent overzealous cleaning can scratch the coatings if all the dust particles (which are often tiny flecks of windborne rock) are not removed before you start pushing a damp tissue around the lens surface. Clean your optics only when absolutely necessary. If you take proper care of your TMB-92, cleaning should rarely be needed.

THE STAR TEST

We strive to make the best apochromatic optical systems available. You may find your lens may not test "perfect" during an extended and stringently-graded "star test," particularly if the scope has not fully reached thermal equilibrium before the test. This is not an indication of a poor optic, but is rather due to the test star's complex wavefront continually changing as the seeing conditions in our living atmosphere vary from moment to moment.

No optic is perfect, and every brand and model scope will show some error in an extended star test. The sensitivity of the star test under perfect conditions is 1/20th wave P-V on the

wavefront for third order aberrations, and 1/60th wave for sharp (fifth order) aberrations. It is highly unlikely that even the most ardent observer can see errors of this small a magnitude on an extended object, even under very good seeing conditions (which is when the atmosphere typically presents no better than a 1/4th wave P-V wavefront to the instrument).

The refractor also presents another factor: the change in spherical aberration with a change in wavelength. This "spherochromatism" is found in all refractors. As a lens is tested in the longer (red) wavelengths, the lens becomes "under-corrected." Tested in the shorter wavelengths (blue), the lens becomes "over-corrected." These overlapping corrections at different wavelengths change the star test pattern from technical perfection.

However, TMB objectives are corrected at the peak visual wavelength centered around 560nm in the green-yellow portion of the visual spectrum. The eye sees over 80% of the visual detail at this wavelength. It is the correction at this visual peak that makes the difference between a merely good objective and a superb one. Our lenses are figured for the best possible wavefront at green-yellow wavelengths, for the sharpest images and highest contrast.

While star tests are interesting and useful, they should not be the only criterion for judging any telescope's quality. Most observers spend their nights enjoying the views of extended and detailed objects – like nebulae, galaxies, star clusters, and planets – not simply examining a star test's single out-of-focus point of light. We feel that the true proof of optical excellence will be found in your nightly observing, not just in star testing.

A FINAL WORD

Thank you for your purchase of our TMB-92. We believe that this ultra-compact apochromatic refractor will outperform any other telescope type, inch for inch, and is the most trouble- and maintenance-free telescope that you can buy. Its versatility for visual, photographic, and CCD work is unmatched. With a little care, this fine apochromatic refractor will last you a lifetime. Use it to enjoy the wonders of the night sky!

BRIEF SPECIFICATIONS

Aperture	92mm (3.6")
Focal Length	506mm
Focal Ratio	f/5.5
Objective Type	air-spaced apochromatic triplet with an FPL-53 ED glass element
Optical coatings	fully multicoated
Resolving Power (Dawes' Limit)	1.26 arc seconds
Visual Limiting Magnitude	12.3
Light Grasp Versus the Eye	173x
Focuser	Starlight Instruments Feather Touch #3025 3" dual speed rack and pinion, with 10:1 ratio fine focus; 2" and 1.25" compression ring eyepiece holders; and 360° rotating camera angle adjuster
Focuser Travel	2.56" (65mm)
Tube Diameter	114mm (4.5") o. d.
Minimum tube Length	13.25" (337mm) (set up for imaging, lens shade and focuser retracted)
Tube Length	16" (406mm) (set up for imaging, lens shade extended, focuser retracted)
Maximum Tube Length	20.75" (522mm) (set up for visual use, lens shade and focuser extended)
Optical Tube Weight	8.5 lbs. (3.86 kg)
Case Dimensions	22.25" x 12.75" x 8"

TMB Optical TMB-92

Thomas M. Back Signature Series

Congratulations on your purchase of this TMB Optical TMB-92 Signature Series air-spaced apochromatic triplet refractor. This exceptional 92mm f/5.5 scope uses an element of costly FPL-53 ED (Extra-low Dispersion) glass to achieve true apochromatic visual and photographic performance, free from chromatic aberration and spurious color.

At only 13.25" in length, the TMB-92 is a premium quality ultra-compact refractor that we believe elegantly and more than capably fills the void left by the long-discontinued 90mm Astro-Physics Stowaway (a legendary refractor that sells for up to \$6000 on the used market).

The fully-collimatable TMB-92's truly outstanding optical and mechanical quality will provide you with many years of highly portable visual observing and imaging enjoyment.

PHOTO/VISUAL CONFIGURATIONS

The TMB-92 consists of an optical tube assembly with lens and dew shield, a Feather Touch focuser that slips into the optical tube and is locked firmly in place by three brass knobs that allow 360° rotation of the focuser, and a 2.25" extension tube that can be installed between the optical tube and the focuser for visual use.

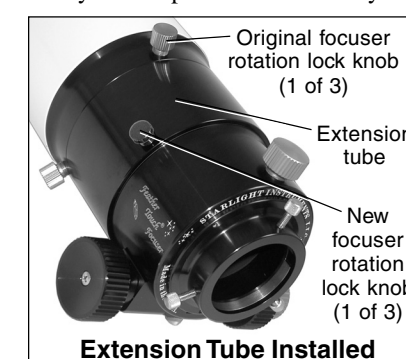


Supplied Extension Tube

When the optical tube and focuser are assembled without the extension tube, the resulting physically short telescope configuration provides the long back focus needed by those primarily interested in serious CCD imaging using long equipment trains: camera, filter wheel, adaptive optics system, etc. This arrangement also allows binoviewer use without the need for a Barlow or optical compensator lens.

For occasional visual work, a simple optional compression ring extension tube (from Astro-Tech, TeleVue, and others) can be slipped into the scope's 2" accessory holder to provide the necessary extra physical length to reach focus with a star diagonal and eyepiece.

For those primarily interested in visual observing and only casual imaging with a 35mm camera, webcam, or Deep Sky Imager-type CCD camera, a 2.25" extension tube (shown above) is supplied to provide the proper back focus for comfortable visual use and casual astrophotography. This extension installs between the optical tube and focuser. A groove in the extension tube engages the large brass lock knobs in the optical tube (that normally control focuser rotation) to lock the extension tube firmly to the optical tube. Three nylon-tipped metal lock knobs



Extension Tube Installed

at the opposite end of the extension tube now lock the focuser in place and allow focuser rotation, just as the large brass lock knobs in the optical tube do when the extension tube is not used. A Teflon insert in the focuser end of the extension tube assures smooth

focuser rotation.

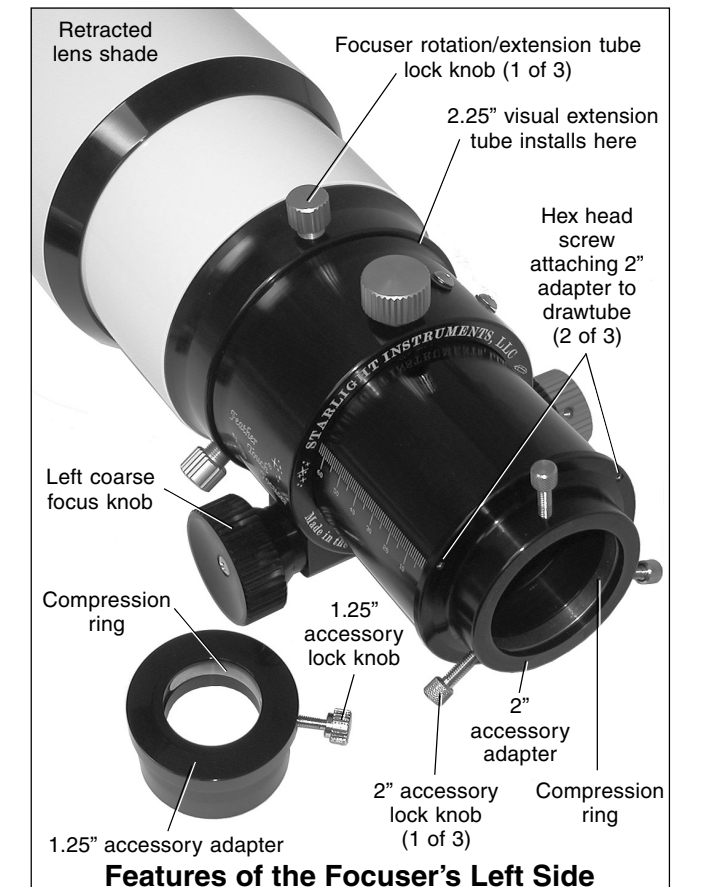
The supplied carrying case is pre-cut to hold the TMB-92 in either short body imaging or long body visual configurations.

FOCUSER

Your TMB-92 features an ultra-precision Feather Touch Model 3025 dual-speed rack-and-pinion focuser from Starlight Instruments. This exceptionally smooth focuser has a 3" diameter drawtube for non-vignetted astrophotography with medium format film cameras and very large chip CCD cameras. The drawtube ends in a 2" accessory adapter with a non-marring compression ring eyepiece/accessory holder that will not damage the barrels of your 2" accessories. Three hand-tighten lock knobs on the adapter assure the compression ring's solid grip on heavy accessory loads. This adapter allows visual use with 2" star diagonals, plus imaging with 35mm film cameras and 2" barrel large format CCD cameras.

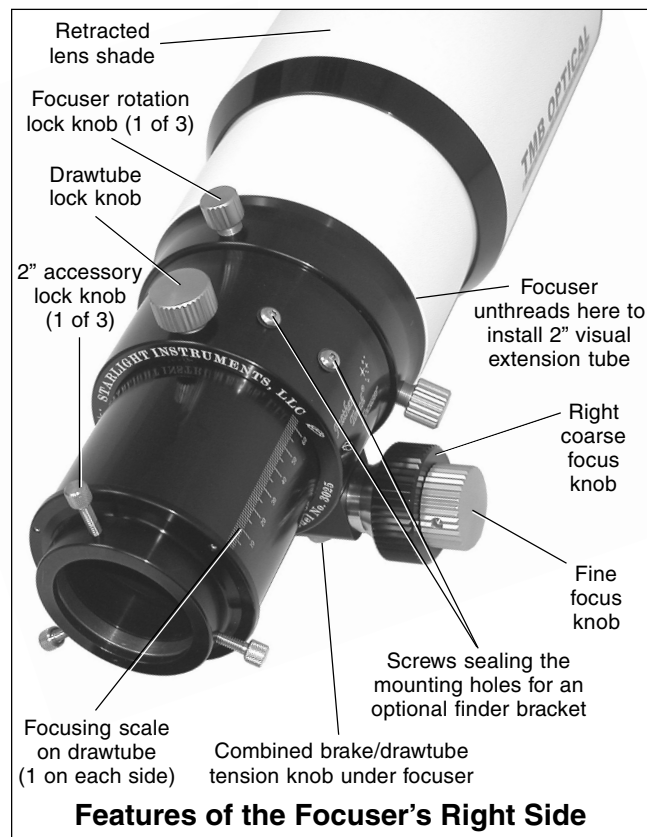
The 2" accessory adapter is secured to the focuser drawtube by three recessed hex-head screws. Undoing these allows you to remove the supplied 2" adapter and replace it with a custom-made Feather Touch adapter for medium format (Pentax 6 x 7) film photography using A-P photographic accessories. Please contact Starlight Instruments directly at (847) 985-9595 for any specialized adapters you may need in this regard.

The supplied 2" to 1.25" accessory adapter is designed for visual use with 1.25" star diagonals, plus imaging with standard 1.25" format CCD, webcam, and 35mm adapters. This



Features of the Focuser's Left Side

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adapter also uses a non-marring compression ring to hold your 1.25" star diagonals and accessories in place. The barrel of this adapter is threaded to accept standard 2" filters and has a slight inward taper at the top. The taper engages the compression ring of the 2" adapter to prevent the 1.25" adapter from slipping out of the focuser, should the 2" adapter's thumbscrew accidentally loosen during use.

Your Feather Touch focuser has dual-speed focusing. There are two coarse focusing knobs. The right knob also has a smaller concentric knob with a 10:1 ratio reduction gear for microfine focusing. This provides exceptionally precise image control during high power visual observing and critical film or CCD imaging. The large focus knobs have ribbed gripping surfaces so they are easy to operate, even while wearing gloves or mittens in cold weather.

Your focuser drawtube has a 65mm (2.56") travel. It has two scales (one on either side) that are laser-engraved in 1mm increments. These let you note individual focuser positions for easy return to the correct focus when switching between visual use and photography.

Because your Feather Touch focuser is so smooth in operation and moves so freely, it can only hold a limited amount of weight (generally about 1 lb.) without drifting out of focus when the focuser drawtube is not horizontal and has a significant vertical component. The focuser therefore contains an adjustable-tension internal brake system to allow astrophotography and visual use with heavy eyepieces without the possibility of focus shift.

The brake consists of a lever arrangement within the focuser's pinion block. Adjusting the thumbscrew underneath the pinion block causes the lever to press a friction pad onto the pinion. This increases the torque needed to turn the focus knobs. If the thumbscrew is turned all the way in (only 1 to 1½ turns), the pinion shaft and drawtube are essentially locked into position. Partial tightening of the internal brake offers a virtually infinite

range of braking force to accommodate various eyepiece and accessory weights.

A separate large hand-tighten drawtube lock knob on the top of the focuser body locks the drawtube securely in place at any desired focus point.

A built-in camera angle adjuster (focuser rotation system) lets you rotate the focuser a full 360° without losing focus. This lets you rotate the focuser to line up a camera in either a landscape or portrait orientation (or any orientation in between). It also lets you put your star diagonal and eyepiece in the most comfortable observing position as you move from one area of the sky to another.

Three hand-tighten focuser rotation lock knobs around the front of the focuser body let you adjust the focuser rotation angle. Loosen the lock knobs by turning them counterclockwise to unlock the focuser. Rotate the focuser to the desired new orientation. Turn all three lock knobs clockwise to lock the focuser firmly in place at the new angle.

Your focuser drawtube glides on three stainless steel straps that mate with Teflon bearing surfaces to provide very tight yet extremely smooth motion. This design eliminates the need for grease between the housing and drawtube. A greaseless drawtube prevents the collection of dirt that may eventually cause problems between these surfaces, so no routine focuser maintenance is required except for an occasional wipe down of the drawtube with a soft cloth.

TUBE RINGS

No tube mounting rings are supplied with your TMB refractor. However, precision-machined 114mm TMB hinged split rings are available from your telescope dealer.

FINDERSCOPE MOUNTING

No finderscope is provided with your TMB-92. However, there are two holes for a finder bracket drilled and tapped on 1.25" centers at the 2 o'clock position on the focuser body. These holes will accept any of a number of finderscope mounting rings. Contact your telescope dealer for an appropriate finder if you do not already have one that is suitable.

COOL DOWN TIMES

For any optical system to give its best wavefront (for the sharpest and highest contrast images), the optics must be at or very near the temperature of the surrounding air. The "cool down" time needed to reach ambient temperature varies considerably, as the temperature of the scope must change from a typical 72° Fahrenheit indoor temperature to an outdoor temperature that can range from a high of over 100° down to 10° below zero or less. In small doublet refractors, the cool down (or heat up) time is quick, usually less than 30 minutes. In subfreezing temperatures, it may take a small refractor twice that time or more to reach its best performance. This is particularly true with triplet refractors, such as your TMB-92, where the thermal load of the center lens is isolated from the surrounding air by the lenses on either side of it. This slows the transfer of the center lens heat load to the outside air.

If you'd like to shorten the wait to reach thermal equilibrium, placing the telescope in an unheated garage for an hour or two before observing can speed up the cool down process considerably. Another technique to shorten the cool down time is to retract the insulating dew shield to allow direct exposure of the cell and lens to the night air so they can reach thermal equilibrium faster. Once the lens has cooled, extend the dew shield again. This provides a faster cool down time, and generally will still keep the lens from dewing up. Only on the highest

dew point nights will the objective lens form dew on its front optical surface.

The best way to avoid dew forming on the lens after you bring the telescope into the house is to take your scope case outside when you observe, so it can also reach ambient temperature. When you are finished observing, cap the telescope with its dust caps and place it into the carrying case. Bring it into the house and let it slowly warm back up to room temperature, then remove the dust caps to allow any trace of dew to evaporate. Once the objective is free from dew, replace the dust caps and store the scope away.

COLLIMATION

Your telescope was carefully collimated prior to shipment to your dealer. With normal care the optics will keep that alignment permanently. However, if the telescope takes a very strong blow in shipping or while transporting it to your observing site, there is the small possibility that you may have to recollimate the lens. The lens cell has three pairs of push-pull collimating screws that will allow you to collimate it using a metric Allen wrench.

To gain access to the collimation screws, remove the black trim ring/knife-edge baffle from the front of the dew shield by unthreading it in a counter-clockwise direction. Set it aside and push the dew shield back on the optical tube until the front of the dew shield clears the lens cell and exposes the collimation screws in the flange at the rear of the lens cell, as shown in the illustration below.

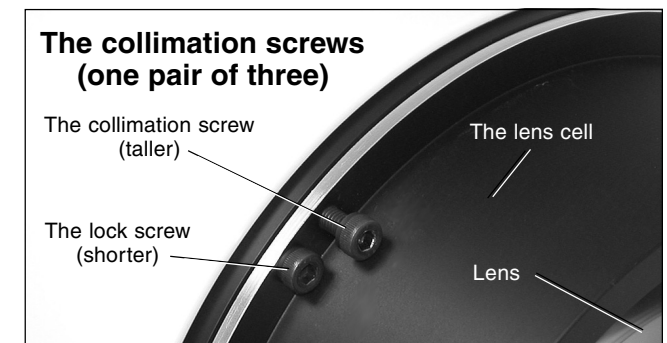


We recommend either of two collimation methods. In the first, a "Cheshire" eyepiece (available from Tectron or your telescope dealer) is inserted directly into the eyepiece holder (without using a star diagonal). The Cheshire method can be used indoors or in the field, day or night.

The dust cover is placed over the lens cell to seal the objective end of the scope and keep light from entering the optical tube. A bright light source is aimed at the opening in the side of the Cheshire eyepiece. You can use the light from the sky outdoors during the day. At night or indoors, aim the light of a flashlight directly at the opening in the side of the Cheshire.

Look through the hole in the end of the Cheshire. You will see a series of faint circles of reflected light against a black background. If the circles of light are all concentric, your scope is in collimation. If the circles of light are not concentric, adjust the push-pull collimation screws until you line up the off-

center circles to form a single round circle. The illustration below shows a close-up of one of the collimation screw pairs.



The taller screw is the actual collimation screw, while the shorter of the pair is the lock screw that holds the proper collimation after adjustment. Be sure to adjust only one set of collimation screws at a time. Loosen the lock screws before attempting to turn the collimating screws. Make only small changes at a time (turning the collimating screw only a fraction of a turn and checking to see the results before turning further).

When you finish adjusting the collimating screws, be sure to snug down all lock screws to hold the correct collimation. Do not over-tighten the lock screws, but make sure they are firmly in place. Once collimation is complete, your objective lens will be on the same optical axis as the eyepiece, camera, or CCD, and you will obtain the best possible optical performance.

The other method of collimation is to examine a first or second magnitude star image at high power at night after the scope has reached thermal equilibrium. This collimation method requires an equatorially-mounted scope and a motor drive to keep the star image centered while you adjust the collimation screws. It is generally a more difficult and time-consuming collimation method than using a Cheshire eyepiece, as you are working with a small and droppable Allen wrench in the dark and are at the mercy of changing seeing conditions.

Be sure not to choose a closely-spaced binary star as your test star. Do not use a star diagonal when collimating, as you may be attempting to correct a problem in the diagonal, rather than in the telescope. Adjust the push-pull collimation screws until the star images are tight and round, and the first and second diffraction rings are uniform in their intensity all the way around the Airy disk.

CLEANING

The best policy is not to let the lens get dirty and/or dusty in the first place. The regular use of the dust caps is highly recommended. However, no amount of preventative measures will keep your objective from eventually collecting dust and airborne pollutants on the first optical surface. We recommend that you do not clean the objective too often, no matter how frequently the urge to do so may hit you. A few specks of dust on the lens will not be visible in your images, as they are not in the focal plane and don't block enough light to measure, let alone be seen.

Depending on how often you use your scope, and the amount of pollutants in your air, you may have to clean your scope as often as twice a year, but generally no more than that – and preferably no more than once a year. If the front lens surface becomes dusty, smeared, or shows fingerprints or any other surface build-up, and you find it absolutely necessary to clean the lens, use the following cleaning technique.

First, gently blow away any surface dust or particles with a clean air blower (a child's ear syringe or a photographer's